A CONTRIBUTION TO THE KNOWLEDGE OF THE STEREOGNOSTIC SENSE.

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Excepting Hoffmann, almost no medical writer has seriously studied the stereognostic sense. It is not mentioned by Mills, Gowers, Brissaud, Oppenheim or Strümpell. Even in articles devoted to sensory phenomena, as those by Laehr, it has been wholly neglected, and the word does not occur in the index of the first thirty volumes of the Archiv für Psychiatrie. The following cases, therefore, are recorded, because in some respects they appear to throw light upon the sensory and psychic elements upon which this form of perception depends.

Case 1. B. A., male, aged 53 years, was admitted to the Presbyterian Hospital, February 24, 1897, suffering from left hemiplegia. He had a history of alcoholism. Although considerable improvement subsequently occurred, the patient is still a cripple, and requires constant attention. His present condition, December 7, 1898, is as follows: no facial paralysis; the left arm is weak, but capable of being moved in all directions; there is slight contracture of the muscles of the forearm, more pronounced in the flexors, so that the hand is habitually held half closed, there is almost no control over the movements of the fingers, but the patient can flex them until they almost touch the palms, and extend them again to their habitual position; the tendon reflexes and the muscle-jerks are all exaggerated. There is a moderate amount of resistance to passive extension of the hand.

Sensation shows the following peculiarities, tactile sense is perfectly normal, the cotton point being felt as readily and identified as promptly on the left side as on the right; localization of contact is exceedingly inaccurate, thus—if the hand is touched, the patient will indicate a point perhaps two inches away from the actual point of contact; if one of the fingers is touched, he is unable to recognize which one. Upon the forearm, he usually indicates a point about an inch above the actual spot. Above the elbow, however, his sense of localization is very good, and elsewhere the sense is well preserved, no essential difference being distinguished between the left and right sides. Recognition of the pain-sense is not, however, as prompt on the left side. Temperature-sense is completely lost in the hand, neither hot nor cold is recognized, or, if either is guessed, the number of errors is greater than the number of correct results. Loss of temperature-sense in the forearm is also pronounced, but above the elbow the number of correct replies is in excess of the mistakes. The muscle-sense is lost in the hands. Trichoesthesia, if this be a separate sense, is everywhere preserved.

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[1] Read before the Philadelphia Neurological Society, Dec. 19, 1898.

Neither slight nor considerable alteration in position of the fingers appears to be perceived by the patient, ordinarily, he answers "up" and "down" alternately without any reference to the nature of the movements made. The same is true of motion at the wrist-joint. At the elbow-joint the answers are usually correct, although occasionally a mistake is made, even after a movement of considerable amplitude. If the patient is told to close his eyes, and the right arm is moved passively into some position, a not altogether unsuccessful attempt is made to reproduce that position with the left arm, and the patient is even more successful when told to imitate the position of the left arm with the right. A more careful investigation of tactile sensibility shows that the patient is unable to distinguish the number of fingers that touch the left hand. Change in the pressure is only noticed when very marked. The patient is unable in a majority of instances to distinguish between hard and soft substances. He has no perception of the shape of objects, nor can he guess their probable nature. The same objects placed in the right hand are recognized at once. A similar loss of tactile perception or *astereognosis*, is observed upon the forearm, that is to say, the patient is unable to distinguish accurately between hard and soft, or between rough and smooth surfaces. This perception is accurate on the right forearm. Of the sensory changes in the other parts of the body, the fine tactile sense is preserved on the face, pain-sense is preserved, but the recognition is somewhat delayed. Temperature-sense is lost to a point within an inch of the median line. Motion on the left side of the face is normal. The sensory phenomena in the left lower extremity are similar to those in the left arm. The patellar reflex is greatly exaggerated, and there is distinct ankle-clonus. Motility is impaired, but not completely lost, as he is able to walk with the aid of a cane held in the right hand.

Dr. C. H. Reed has kindly furnished me with the notes of the eye-examinations: At first there were choked disks, conjugate deviation, unequal pupils, and left hemianopsia; these disappeared, but the form fields remained diminished, and the right halves of the retinæ less sensitive. The case is interesting because it enables us to determine approximately the sensory constituents of astereognosis.

The stereognostic sense is an exceedingly complex perceptive phenomenon, involving an intricate correlation of tactile-, position-, pressure-, localization-, and temperature-perceptions, and its interpretation by the higher psychic centers; but it does not follow that all these forms of sensation are equally important and that none of them are dispensable. Hoffman[2] states that the stereognostic may be lost when the temperature-, contact-, pain-, localization-, and muscular-sense are preserved. The recognition of area, pressure, passive movement, and the position of the limbs appears to be more important, although any one of them may be diminished, or even only one preserved, without loss of the stereognostic sense. The most important elements are the recognition of space and of pressure. If motion is impaired, and there is also anesthesia, the results are uncertain. Largely due to Hoffman's teaching, it has been the fashion to ascribe astereognosis in great measure to the loss of muscular sense, although he does not explicitly state that the latter is of such importance. His last statement is difficult to understand. Tactile perception must, of course, be present, for it is inconceivable that a person suffering from total anesthesia should be able to recognize an object by touch. Pressure- and temperature-sense are more concerned in the recognition of the density and nature (by their heat-abstracting power) of objects. The relative parts played by the position- (muscular) and the localization-sense are more difficult to determine. In the case reported, tactile sense is preserved, and the stereognostic sense is, nevertheless, lost. We must, therefore, assume that if the lesion is in, or peripheral to, the perceptive sensory centers, as is evident from the fact that the sense is preserved on the other side of the body, one of the lacking sensations, or a combination of two or more of them, is indispensable to its existence.

The patient had almost complete loss of muscle-sense, inability to distinguish moderate changes of pressure, failure to recognize the consistency of bodies, and disturbance of the localizing sense of the left hand. Every effort was made when an object was placed in his hand, by manipulating the fingers, and changing the position of the object, to obtain some information regarding its nature from him. Occasionally, after moving the object about, he would guess correctly that it was long or short, thick or thin, or make some other general statement that indicated a certain degree of perception. More frequently, however, he would insist that it was impossible for him to recognize any of its features. In this case the fingers remained passive, and muscle-sense was, therefore, largely excluded in the examination, even aside from the fact that it was lost. The following cases have been recorded more or less fully, and aid in throwing light upon the subject.

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[2] Hoffman, quoted by Möbius, Diagnostik der Nervenkrankheiten, Leipzig, 1894.

Wernicke[3] records the case of a tailor's apprentice who was struck upon the head with a stick. Immediately afterward there were loss of speech, diminution of power, and considerable inco-ordination of the right arm, and the following day, after the removal of the splinter of bone, complete paralysis of the fingers and hand, although movement of the forearm and arm remained. The muscle-sense, that is, the recognition of passive movement, was completely lost. There was diminution of tactile sense, but no alteration of pain- or temperature-sense. In the course of a few days, there was some improvement in the power of the hand, but a permanent disturbance of the stereognostic sense was discovered, which after five years had not greatly improved. No record is given concerning the ability to localize contact.

von Monakow[4] reports the case of a man, 25 years of age, who was struck by a piece of wood in the left parietal region. Upon recovering consciousness, the patient noticed that the right arm was paralyzed, and had completely lost sensation. At the operation, a splinter of bone was found in the posterior central convolution. Eight days later motion had returned to a considerable extent, but the thumb and fingers remained paretic. The localization of tactile impressions and the temperature sense were somewhat diminished, the muscle-sense was much disturbed, and there was complete loss of the stereognostic sense. Several months later, this loss of the stereognostic sense persisted, although it was no longer absolute, but the other sensory disturbances had diminished. It is not noted whether the recognition of passive movements was still lost, but there was some ataxia of the right arm, especially noticeable in writing and drawing.

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[3] Wernicke, Arbeiten aus der psychiatrischen Klinik in Breslau. Heft 2, page 235. Leipsic, 1895. Quoted by v. Monakow in Gehirnpathologie.

[4] v. Monakow, Gehirnpathologie, Vienna, 1897.

Burr[5] reports the case of a man, 24 years of age, who, when 10 years old, received a blow on the side of the head, causing a depressed fracture of the right parietal bone, over the motor area. Several months later after the post-traumatic paralysis and anesthesia had disappeared, the patient discovered that he had completely lost the stereognostic sense in the left hand. At the time of examination, the tactile sense was normal on both sides, but there was complete loss of the localization of contact on the left side. Temperature- and pain-sense were normal, and he was able to recognize passive motion promptly and correctly.

Olmsted[6] reports the case of a man, 27 years of age, whose sickness commenced with double vision, followed by numbness in the right thumb and fingers. In the right hand, the senses of touch, pain, heat and cold were impaired. Later, there was marked ataxia in the right arm and hand, disturbance of writing, and dulness of the sense of pain. The tactile and temperature-sense were still normal, but there was absolute astereognosis of the right hand. This loss of the recognition of objects apparently extended over the whole of the right side, that is to say, the patient could not recognize a brush, a hard object or the shape of the object on this side, while he was able to do so perfectly on the left side. The pressure-sense was also completely lost. A bottle containing 3 ozs. of mercury appeared as heavy as one containing 9 ozs. Passive movements were recognized at once.

In all these cases, including my own, the tactile sense appears to have been practically normal, or, at least, only slightly diminished. It is therefore possible, to a certain extent, to determine what other elements are capable of causing the loss of the stereognostic sense. I have been unable to obtain the original report of Wernicke's case, but in the abstract given by von Monakow, it is not stated whether the sense of localization was lost or not. In von Monakow's case, this sense was diminished, and in Burr's and mine completely lost. Olmsted apparently failed to test it. The muscle-sense was completely lost in Wernicke's, disturbed in von Monakow's, and intact in Burr's and Olmsted's cases. In mine it was lost. Olmsted mentions disturbance of the pressure sense, which was lost in my case. In regard to the other sensations, in Wernicke's case the pain- and temperature-sense were undisturbed; in von Monakow's, the temperature-sense was slightly diminished; in Burr's case, the temperature- and pain-sense were normal; in Olmsted's they were slightly impaired, and in my case temperature-sense was lost, and pain-sense diminished. It appears, therefore, that in all cases in which record was made of the fact, the localization-sense was lost or greatly impaired. The muscle-sense was lost in two cases, normal in two and disturbed in one. The sense of pain was disturbed in two cases, and the temperature-sense lost in one and impaired in another.

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[5] Burr, Journ. of Nervous and Mental Disease, Jan., 1898; also Univ. Med. Mag., Oct., 1897.

[6] Olmsted, Journ. of Nervous and Mental Disease, Nov., 1898.

In order to determine the relative importance of the muscle-sense—that is, the sense of position—and of the sense of localization of tactile impression, I have conducted, rather roughly, a series of experiments upon normal persons. These were in general performed as follows: the subject was instructed to lay the hand, back downward, flat upon the table, and then, while it remained passive, various objects were placed upon the palm and fingers. If their lower surfaces were irregular, or if the objects themselves were very light, pressure was used to make the contact more distinct. As a result, in nearly all cases the size of the object was correctly given, and even its exact nature was suspected. The perception of size was slightly better on the fingers, in some instances, than upon the palm. The thumb and one of the fingers were then brought in opposition, the object placed between them, and the patient requested to estimate the diameter of the object included in the grasp. This was frequently done with as great accuracy, but never with greater accuracy, than when the object was laid upon the passive hand.

In two cases, one of them a draughtsman, familiar by occupation with dimensions, it was distinctly inaccurate. The fingers were then flexed toward the palm, and the object placed between them and the palm of the hand. Seven subjects expressed a sense of decided difference between the diameter as estimated by this method and as estimated by opponation; the diameter appearing to be very much less, sometimes the difference being as much as half an inch in two persons tested. In an eighth subject, an engineer familiar with measurements, the diameter by this method appeared to be considerably larger, and he expressed the opinion that a cent held thus was a larger coin than a five-cent piece held between the thumb and finger. When the subjects were requested to separate the fingers or a finger and the thumb a certain distance, one of them was able to do so with extraordinary accuracy, the error usually being less than an eighth of an inch. None of the others, perhaps from lack of practice or on account of a less delicate sense of perception of distance, were able to approach this result. It seems from these experiments, that the contact-sense, if I may so call the combination of pressure-, tactile- and localization-sensations, is considerably more accurate than the simple muscular sense, that is, a knowledge of the exact position of the finger or hand, and these results coincide with those obtained by a study of the pathological cases reported.

The stereognostic sense is, however, not merely a matter of sensory perception. The object to be recognized is necessarily complex, and, as I have shown, a variety of sensations are employed in its recognition. It follows that a correlation of these sensations must take place in some higher center or complex of centers. This must then be compared with similar correlations that have taken place in the past, and recognition must be accomplished by the aid of memory. It would seem *a priori* possible, therefore, that cases should occur in which there were no sensory disturbances, and, nevertheless, there was loss of the ability to recognize the nature of objects. Such a case was recently admitted to the Presbyterian Hospital under the care of Dr. Musser.

Case II.—The patient, a music-teacher, 55 years of age, on the 24th of December, 1898, while talking with some friends, suddenly discovered that the left side was paralyzed. There had been no loss of consciousness, and there were no symptoms of shock. When examined, four days later, the tactile sense on the whole of the left side was greatly impaired. It was completely lost in the forearm and hand and in the leg and foot. Muscle-sense was completely lost in the left arm, although the patient seemed to be able to recognize the position of the arm to a certain extent by its weight. Temperature-, pain-, localization- and pressure-sense were completely lost, although this loss was not absolute above the elbow. On the left leg, similar, but not quite as severe, disturbances of sensation were found. The patellar reflex was present on the left side, but not exaggerated. The Achilles-tendon reflex was lost, and there was no ankle-clonus. Sinkler's reflex, *i. e.* toe-jerk, was present. The stereognostic sense was naturally completely lost on the left side. On the right side all forms of sensation were normal. The stereognostic sense was, however, extremely imperfect on this side. The fields of vision were roughly tested, and the patient found to be suffering from complete left lateral hemianopsia. The following day, Dr. Schaffner, at my request, made an examination, and was able to detect, in addition, a horizontal hemianopsia, so that the patient only perceived the upper right quadrant of the normal field of vision, and even this was considerably contracted. There were no changes in the fundus. On the following day, the sensory phenomena remained unchanged on both sides. The stereognostic sense was, however, normal on the right side. On both sides the power of recognizing writing on the hand was lost. From this time rapid improvement occurred, and three weeks later, the patient was able to give some description of objects placed in the left hand, and in the course of a few days, he made a not altogether unsuccessful attempt to play the organ.

A case somewhat similar to this has been reported by Burr[7]. The patient, a colored woman, 60 years of age, had been suddenly attacked by partial failure of vision, which rapidly increased until she was unable to distinguish objects. She was usually apathetic, but not apparently insane. There was no paralysis, but the patient staggered slightly when walking. Speech was normal. Touch-, pain- and temperature-sensations were everywhere normal, and the point of contact was correctly localized. She was unable to recognize an object placed in the hand, although the loss of the stereognostic sense was not absolute, for it is stated that she could recognize a silver half dollar and the finger. Burr regards the case as one of mind-blindness. He also mentions a similar case that he saw in Weir Mitchell's clinic, in which the patient had had loss of the power of recognizing coins, but this had returned later. In both of these cases, the characteristic feature of the loss of the stereognostic sense, that is to say, the loss on the right side in the case I report, and on both sides in Dr. Burr's case, was the preservation of all the cutaneous sensory perceptions, and it seems justifiable to locate the lesion somewhere in the higher centers by which objects are recognized. This is not necessarily a definite group of cells, for Brissaud[8] contends that even such well-organized actions as writing or reading are performed, not by definite centers, but by a group of centers, the communications between which have been rendered more direct by constant employment.

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[7] Burr, Journal of Nervous and Mental Disease, 1897.

Exner[9] and Ziehen[10] have also suggested a similar theory for apperception, basing it upon the well-known physiological law, that the irritation of a portion of the central nervous system leaves, for a short time, an increased irritability in the excited part. Indeed, Exner suggests that memory is largely the result of the increased irritability of certain complex routes.

Kattwinkel[11] has recently investigated a somewhat analogous subject—the ability of the patient to recognize letters written with a blunt object upon the skin. He finds that this is lost in conditions in which there is alexia or sensory anesthesia. Even in the former condition, mere sensation may be so accurate that the stereognostic sense is preserved; as occurred in a case of a man 74 years of age, who suddenly lost his speech as the result of an accident. There was, however, no hemiparesis and no disturbance of sensation. Kattwinkel suggests the theory that this ability to recognize letters is due to the combined action of the tactile, visual and speech-centers, and it is highly probable that a similar combination of mental processes is necessary for the recognition of objects.

The following conclusions appear to be justified:

1st. The stereognostic sense is due to a complex sensory perception, the impulses of which are probably received in the parietal lobe of the brain, and then recognized in consciousness by some higher center or group of centers. It may be lost if either one of these centers is disturbed.

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[8] Brissaud, La Presse médicale, 1898.

[9] Exner, Physiologische Erklärung der psychischen Erscheinungen. Leipsig, 1894.

[10] Ziehen, Leitfaden der physiologischen Psychologie, June, 1893.

[11] Kattwinkel, Deutsches Archiv für klin. Med., Oct. 27, 1898.

2d. In case of peripheral disturbance, that is, some disturbance in or between the center in the parietal lobe and the terminations of the sensory nerves in the skin, stereognosis is lost if tactile sense is lost, and it is greatly impaired or lost if localization-sense is lost; it is usually, but not always, disturbed if the muscular sense is lost, but may persist if any of the other forms of cutaneous sensation are lost or disturbed.

3d. The apperceptive center may be disturbed as a result of severe injury to the brain, as, for example, in apoplexy, and in these cases the stereognostic sense may be lost, even although all forms of sensory phenomena are preserved.

I desire to express my thanks to Dr. John H. Musser, who has generously permitted me to use the two cases here reported.

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31. STATISTISCHE BETRACHTUNG ÜBER ALLGEMEINE PARALYSE, NACH DEM MATERIAL DER OBERBAYRISCHEN KREISIRRENANSTALT GABERSEE (Statistical Contribution on General Paresis from Gabersee), v. Oscar Müller (Allgemeine Zeitschrift f. Psychiatrie, 54. 1898, p. 1027).

At the Gabersee institution during the years 1883 to 1897 inclusive, there were admitted some 1,158 patients, of which 122 or 10.6 per cent. suffered from general paresis. This number served as a basis for the author's statistical contribution. A large number of these patients were women; 45 in number, the men being 77; or 1 woman to every 1.7 men, which is an unusually high average. Among the etiological factors, syphilis seemed low, in the men being found in 17 per cent., and in the women 6.4 per cent. Syphilis or alcohol together gave a general average of some 60 per cent. Heredity, especially nervous disease in the parents, seemed to play an important role. It was found in 46 per cent. of the men and 64 per cent. of the women. The average age of onset for men was between thirty-six and forty, while for women two periods seemed favorable, from twenty-six to thirty, and from forty-five to fifty. The duration varied in the men from seven months to seven years, in the women from one year to nine years. Thirty-six cases died in convulsions. There were over eighty post mortem examinations recorded. Among the statistics given with reference to the findings, it was shown that at least 50 per cent. showed chronic pachymeningitis externa, 81 per cent. showed distinct granulation of the ependyma, 76 per cent. had enlarged ventricles, and in 96 per cent. the brain showed the characteristic gelatinous serous infiltration. In four cases only were there any softenings found, and only one case of new growth was observed.